

$$46. a) \quad t = \frac{\ln 2}{r} \quad D = \frac{\ln 2}{k}$$

$$b) \quad y_1 = \frac{\ln 2}{r} \approx \frac{.69}{r} \quad r = \text{rate in decimal form}$$

$$y_2 = \frac{70}{100r} = \frac{.70}{r}$$

$$y_3 = \frac{72}{100r} = \frac{.72}{r}$$

$$d) \quad \frac{\ln 3}{r} = \frac{1.09}{r} \quad \frac{1.10}{r}$$

Dec 7-9:15 AM

6.4b Exponential Growth and Decay

Newton's Law of Cooling: The rate at which an object's temperature is changing is directly proportional to the difference between its temperature and the temperature of the surrounding medium.

T = Temp of Liquid

T_s = Temp of surroundings

T_0 = Initial Temp

t = time

$$\frac{d(T - T_s)}{dt} = k \cdot (T - T_s)$$

$$T - T_s = (T_0 - T_s) e^{-kt}$$

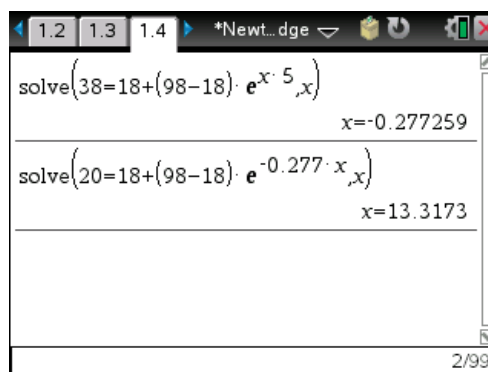
$$T = T_s + (T_0 - T_s) e^{-kt}$$

$$\frac{dy}{dt} = ky \quad y = y_0 e^{-kt}$$

Dec 6-10:18 PM

A hard boiled egg at 98 degrees Celsius is put in a pan under running 18 degree water to cool. After 5 minutes, the egg's temperature is found to be 38 degrees. How much longer will it take the egg to reach 20 degrees?

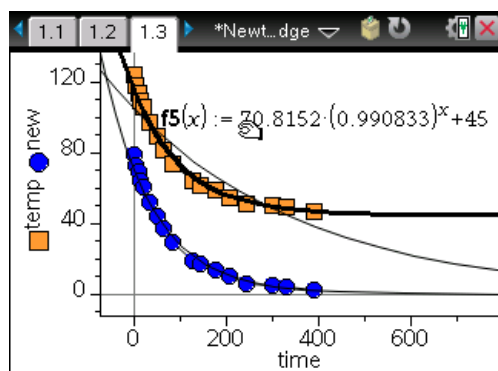
$$T = T_s + (T_0 - T_s) e^{-kt}$$



Dec 6-10:23 PM

Newton's Law of Cooling
 A cup of hot ~~water~~ ^{chocolate} was placed in the fridge. The temperature was checked at somewhat regular intervals. See the data on the next page. Make a scatter plot and find the exponential regression equation.

A	time	B	temp	C	D
1	0	124			
2	5	118			
3	10	114			
4	16	109			
5	20	106			



$$T = 45 + 70.8(0.9908)^x$$

$$T = T_s + (T_0 - T_s) e^{-kt}$$

$$e^{-kt} = (e^{-k})^t$$

$$e^{-k} = .9908$$

Dec 6-10:25 PM

Separation of Variables

Solve for y if $\frac{dy}{dx} = (xy)^2$ and $y=1$ when $x=1$

$$\frac{dy}{dx} = x^2 y^2$$

$$\int \frac{dy}{y^2} = \int x^2 dx$$

$$\int y^{-2} dy = \int x^2 dx$$

$$\frac{y^{-1}}{-1} = \frac{x^3}{3} + C$$

$$-\frac{1}{y} = \frac{x^3}{3} + C$$

$$-y = \frac{1}{\frac{x^3}{3} + C} \cdot \frac{3}{3}$$

$$y = \frac{-3}{x^3 + C}$$

$$\text{ic } 1 = \frac{-3}{1+C}$$

$$1+C = -3$$

$$C = -4$$

$$\boxed{y = \frac{-3}{x^3 - 4}}$$

Dec 6-10:49 PM